WHAT IS CLAIMED IS:

1. A method for calibrating a subsurface gravity measurement device having a tilt meter and a gravity sensor, said method comprising:

associating tilt information produced by said gravity sensor as a function of tilt information produced by said tilt meter and at least one initial correction parameter;

producing tilt data with said tilt meter, and gravity data, corresponding to said tilt data, with said gravity data being produced by said gravity sensor;

fitting said tilt data and said gravity data to a polynomial equation, with said polynomial equation having a plurality of initial coefficients associated therewith, said initial coefficients including information concerning said at least one initial correction parameter;

deriving said at least one correction parameter as a function of said initial coefficients; and

calibrating said gravity measurement device using said at least one correction parameter.

2. The method of claim 1 wherein deriving said correction parameter further includes determining values for said plurality of initial coefficients using a least-squares regression.

3. The method of claim 1 wherein producing tilt data further includes orientating said tilt meter in a plurality of differing angular positions with respect to a plumb line, defining tilt data, and measuring, with said gravity sensor, gravity information at each of said angular positions, defining said gravity data.

4. The method of claim 1 wherein producing tilt data further includes orientating said tilt meter in at least five differing sets of angular positions with respect to said plumb line, defining tilt data, and measuring, with said gravity sensor, five gravity measurements, defining said gravity data.

5. The method of claim 1 wherein deriving said correction parameter further includes determining values for said plurality of initial coefficients using a least-squares

regression having a weighting function, σ^2, applied thereto, and deriving said correction parameter as a function of said initial coefficients.

6. The method of claim 1 further including determining whether said initial coefficients satisfy a goodness fit criteria defined by a chi-square statistic, χ^2.

7. The method of claim 6 further including producing additional tilt data and additional gravity data and fitting said additional tilt data and said additional gravity data to an additional polynomial equation having additional coefficients associated therewith, upon determining said initial coefficients failed to satisfy said goodness fit criteria, and deriving said correction parameter as a function of said additional coefficients.

8. The method as recited in claim 1 further including determining whether said initial coefficients satisfy a goodness fit criteria defined by a normalized chi-square statistic, χ_v^2, and producing additional tilt data and additional gravity data and fitting said additional tilt data and said additional gravity data to an additional polynomial equation having additional coefficients associated therewith, upon determining said initial coefficients failed to satisfy said goodness fit criteria, and deriving said correction parameter as a function of said additional coefficients.

9. The method of claim 1 further including determining whether said initial coefficients satisfy a goodness fit criteria defined by a normalized chi-square statistic, $\chi^2/(N-n)$, where N corresponds to a number of data points in said gravity data and n corresponds to 5, and producing additional tilt data and additional gravity data and fitting said additional tilt data and said additional gravity data to an additional polynomial equation having additional coefficients associated therewith, upon determining said initial coefficients failed to satisfy said goodness fit criteria, and deriving said correction parameter as a function of said additional coefficients.

10. The method of claim 1 wherein said correction parameter includes information concerning the difference in an angular deviation said tilt meter is from said plumb

line compared to an angular deviation of said gravity sensor from said plumb line and further including determining an initial fit measurement of said initial coefficients and producing additional tilt data and additional gravity data and fitting said additional tilt data and said additional gravity data to an additional polynomial equation having additional coefficients associated therewith, and determining an additional goodness fit measurement of said additional coefficients and comparing said initial goodness fit measurement with said additional goodness fit measurement to determine whether said angular deviation has changed.

11. A method for calibrating, with respect to a plumb line, a gravity measurement device having a tilt meter and a gravity sensor, said method comprising:

associating tilt information produced by said gravity sensor as a function of a relationship between tilt information produced by said tilt meter and at least one initial correction parameter;

orientating said tilt meter in a plurality of differing angular positions with respect to said plumb line, defining tilt data;

measuring, with said gravity sensor, gravity information at each of said angular positions, defining gravity data;

fitting said tilt data and said gravity data to a polynomial equation, with said polynomial equation having a plurality of initial coefficients associated therewith, said coefficients including information concerning said at least one correction parameter;

determining values for said plurality of initial coefficients using a least-squares regression;

deriving said at least one correction parameter as a function of said coefficient values; and

calibrating said gravity measurement device using said at least one correction parameter.

12. The method of claim 11 wherein producing tilt data further includes orientating said tilt meter in at least five differing sets of angular positions with respect to said plumb line, defining tilt data, and measuring, with said gravity sensor, five gravity measurements, defining said gravity data.

13. The method of claim 11 wherein deriving said correction parameter further includes determining values for said plurality of initial coefficients using a least-squares regression having a weighting function, σ^2, applied thereto.

14. The method of claim 11 further including determining whether said initial coefficients satisfy a goodness fit criteria defined by a chi-square statistic, χ^2.

15. The method of claim 14 further including producing additional tilt data and additional gravity data and fitting said additional tilt data and said additional gravity data to an additional polynomial equation having additional coefficients associated therewith, upon determining said initial coefficients failed to satisfy said goodness fit criteria, and deriving said correction parameter as a function of said additional coefficients.

16. The method of claim 11 further including determining whether said initial coefficients satisfy a goodness fit criteria defined by a normalized chi-square statistic, $\chi^2/(N-n)$, where N corresponds to a number of data points in said gravity data and n corresponds to 5, and producing additional tilt data and additional gravity data and fitting said additional tilt data and said additional gravity data to an additional polynomial equation having additional coefficients associated therewith, upon determining said initial coefficients failed to satisfy said goodness fit criteria, and deriving said correction parameter as a function of said additional coefficients.

17. The method of claim 11 wherein said correction parameter includes information concerning the difference in an angular deviation said tilt meter is from said plumb line compared to an angular deviation of said gravity sensor from said plumb line and further including determining an initial fit measurement of said initial coefficients and producing additional tilt data and additional gravity data and fitting said additional tilt data and said additional gravity data to an additional polynomial equation having additional coefficients associated therewith, and determining an additional goodness fit measurement of said additional coefficients

and comparing said initial goodness fit measurement with said additional goodness fit measurement to determine whether said angular deviation has changed.

18. A subsurface gravity measurement device, comprising:

a body;

a tilt meter connected to said body to produce tilt data concerning angular positions said tilt meter forms with respect to a direction of gravity, with said direction of gravity defining a plumb line;

a gravity sensor connected to measure said gravity and to produce information corresponding thereto, defining gravity data, with said information being a function of an angle said gravity measurement device forms with respect to said plumb line, defining tilt information;

a processor in data communication with both said gravity sensor and said tilt meter; and

a memory in data communication with said processor, said memory including a computer readable program to be operated on by said processor that includes a first subroutine to define a relationship between said tilt information produced by said gravity sensor and both said tilt data and an initial correction parameter, and a second subroutine to fit said tilt data and said gravity data to a polynomial equation, with said polynomial equation having a plurality of initial coefficients associated therewith, said initial coefficients including information concerning said correction parameter, and a third subroutine to derive a correction parameter as a function of said initial coefficients.

19. The device of claim 18 wherein said subroutine to ascertain said correction parameter further includes a code to determine values for said plurality of initial coefficients using a least-squares regression; and derive said correction parameter as a function of said initial coefficients.

20. The device of claim 18 wherein said subroutine to produce tilt data further includes code to orientate said tilt meter at a plurality of differing angular positions with respect to said plumb line, defining tilt data, and code to measure, with said gravity

sensor, gravity information at each of said angular positions, defining said gravity data.

21. The device of claim 18 further including a subroutine to determine whether said initial coefficients satisfy a goodness fit criteria defined by a chi-square statistic, χ^2.

22. The device of claim 21 further including a subroutine to produce additional tilt data and additional gravity data and fit said additional tilt data and said additional gravity data to an additional polynomial equation having additional coefficients associated therewith, upon determining said initial coefficients failed to satisfy said goodness fit criteria, and derive said correction parameter as a function of said additional coefficients.

23. The device of claim 18 wherein said correction parameter includes information concerning the difference in an angular deviation said tilt meter is from said plumb line compared to an angular deviation of said gravity sensor is from said plumb line and further including a subroutine to determine an initial fit measurement of said initial coefficients and produce additional tilt data and additional gravity data and fit said additional tilt data and said additional gravity data to an additional polynomial equation having additional coefficients associated therewith, and determine an additional goodness fit measurement of said additional coefficients and a subroutine to compare said initial goodness fit measurement with said additional goodness fit measurement to determine whether said angular deviation has changed.